RRS-IFS-101
February 1991

VEHICLE/PAYLOAD INTERFACE SPECIFICATION FOR THE REUSABLE REENTRY SATELLITE

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
Contract NAS9-18202
DRL 04

Prepared by
Science Applications International Corporation

Prepared for
Lyndon B. Johnson Space Center

SAIC RRS-044

An Employee-Owned Company

21151 Western Avenue
Torrance, California 90501

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INTERFACE SPECIFICATION

REUSABLE REENTRY SATELLITE

Vehicle Segment to Payload Segment

APPROVAL/CONCURRENCE

	Organization	Signature	Date
NASA/JSC			
RRS Vehicle Contractor			
NASA/ARC			
Payload Contractors			

NOTE

This specification has been prepared for the Rodent Module per contract requirements. Therefore, Addendum A-RM-1 contains no changes to the basic specification. The preferred practice would be to have a general interface specification in which the payload-unique details are provided in an Addendum like A-RM-1.

CONTENTS

FIGURES

1.0 SCOPE

1.1 ITEM DESCRIPTION

This document describes the common interface requirements between the Vehicle Segment and the Payload Segment of the Reusable Reentry Satellite (RRS) system. The system consists of a single transport vehicle design that provides a uniform, unidirectional payload gravitational environment which is selectable during on-orbit operations over the range of 10^{-5} (microgravity) to 1.5 g's. The initial Reusable Reentry Vehicle/Payload Module (RRV/PM) integration and checkout will occur at the launch base unless otherwise agreed to in a mission-unique addendum to this specification. Pre-integration interface qualification shall be done using emulators as described below.

The RRS consists of a:

a) Vehicle Segment. The Vehicle Segment consists of the RRV and a Vehicle Emulator (VE) as defined in RRS-RV-200. The RRV provides all payload support from lift-off to up to 2 hours following landing via the set of common interfaces described herein. All payload command and control is provided via the RRV Telemetry, Tracking and Command (TT&C) subsystem. The VE precisely simulates these interfaces and is provided as Contractor Furnished Equipment (CFE) by the vehicle contractor to the payload contractor for qualification of interface to the RRV. A VE will also be used as the vehicle portion of the Ground Control Experiment Module (GCEM).

b) Payload Segment. The Payload Segment consists of various PMs and associated Payload Module Emulators (PMEs). The only restrictions on the individual payload modules are contained within this document. Any interfaces identified as tailorable (T) and any payload/mission specific requirements shall be specified in the mission-unique addendums. The PME precisely simulates the PM/RRV interfaces and is provided as CFE by the payload contractor to the vehicle contractor for qualification of interface to the RRV. A PM will also be used as the payload portion of the GCEM.

1.2 CONTRACTORS

The RRV contractor shall have the prime responsibility for RRV/PM interface control. Each payload contractor shall be solely responsible for identifying and obtaining agreement to any mission-unique requirements. The RRV shall not be responsible for any payload support not specifically quantified herein.

Item	Function/Contractor	Mission Addendum
RRV	Reusable Reentry Vehicle (Contractor TBD)	Not Applicable
RM	Rodent Module (Contractor TBD)	A-RM-1

2.0 APPLICABLE DOCUMENTS

The following documents of the exact issue shown form a part of this specification to the extent specified herein. In the event of conflict between the documents referenced herein and the contents of this specification, the contents of this specification shall be considered a superseding requirement.

RRS-SS-100 February 1991	System Specification for the Reusable Reentry Satellite
RRS-RM-200 February 1991	Segment Specification for the Payload Segment of the Reusable Reentry Satellite
RRS-RV-200 February 1991	Segment Specification for the Vehicle Segment of the Reusable Reentry Satellite
NASA SP-R-0022A 09 Sep 1974	General Specification, Vacuum Stability Polymeric Material for Spacecraft Application
DOD-HDBK-343 (USAF)	Design, Construction, and Testing Requirements for One of a Kind Space Equipment

MIL-STD-461C 04 Aug 1986 Notice 1 01 Apr 1987	Electromagnetic Emission and Susceptibility Requirement for the Control of Electromagnetic Interference
MIL-STD-462C 31 July 1968 Notice 1 through 6 15 Oct 1987	Electromagnetic Interference Characteristics, Measurement of
MIL-STD-889 07 July 1976 Notice 1 21 Nov 1979	Dissimilar Metals
MIL-STD-1539 (USAF) 01 Aug 1973	Electric Power, Direct Current Space Vehicle Design Requirements
MIL-STD-1541 (USAF)	Electromagnetic Compatibility Requirements for Space Systems
MIL-STD-1553B 21 Sep 1978	Aircraft Internal Time Division Command/Response Multiplex Data Bus

3.0 INTERFACE REQUIREMENTS

The mission operations profile for each specific mission shall be included by reference in the appropriate addendum.

3.1 PHYSICAL INTERFACE

3.1.1 The payload shall fit inside the dynamic envelope as described in Figure 1.

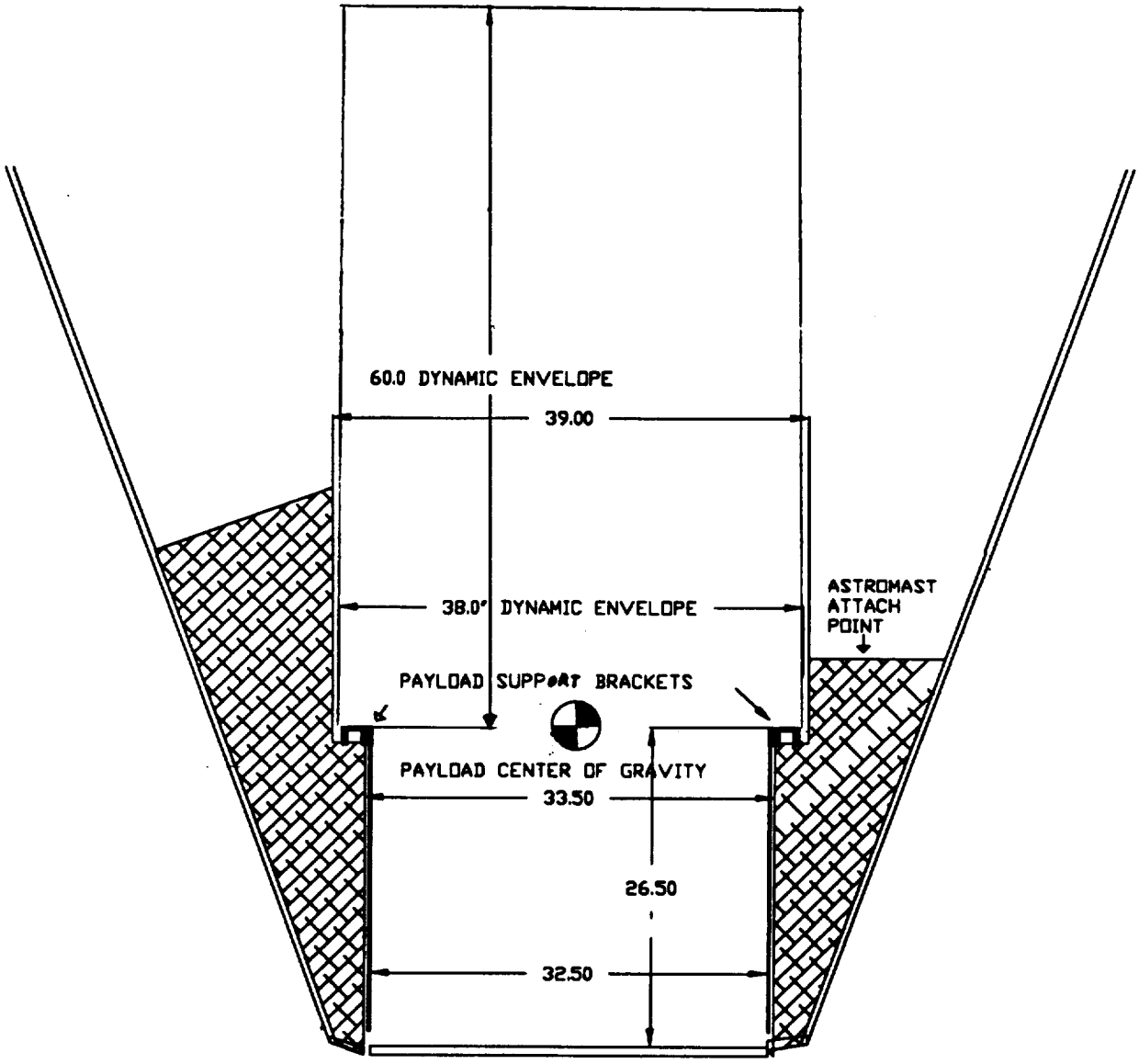

Figure 1. Dynamic Envelope and Mounting Provisions

3.1.2 The payload shall provide mounting provisions to mate with the vehicle mounting provisions as described in Figures 1, 2, and 3.

3.1.3 The stiffness of the RRV PM mounting structure shall be as described by the stiffness matrix in Figure 4.

3.1.4 The vehicle contractor will provide tooling to the payload contractor to accurately locate the payload mounting holes.

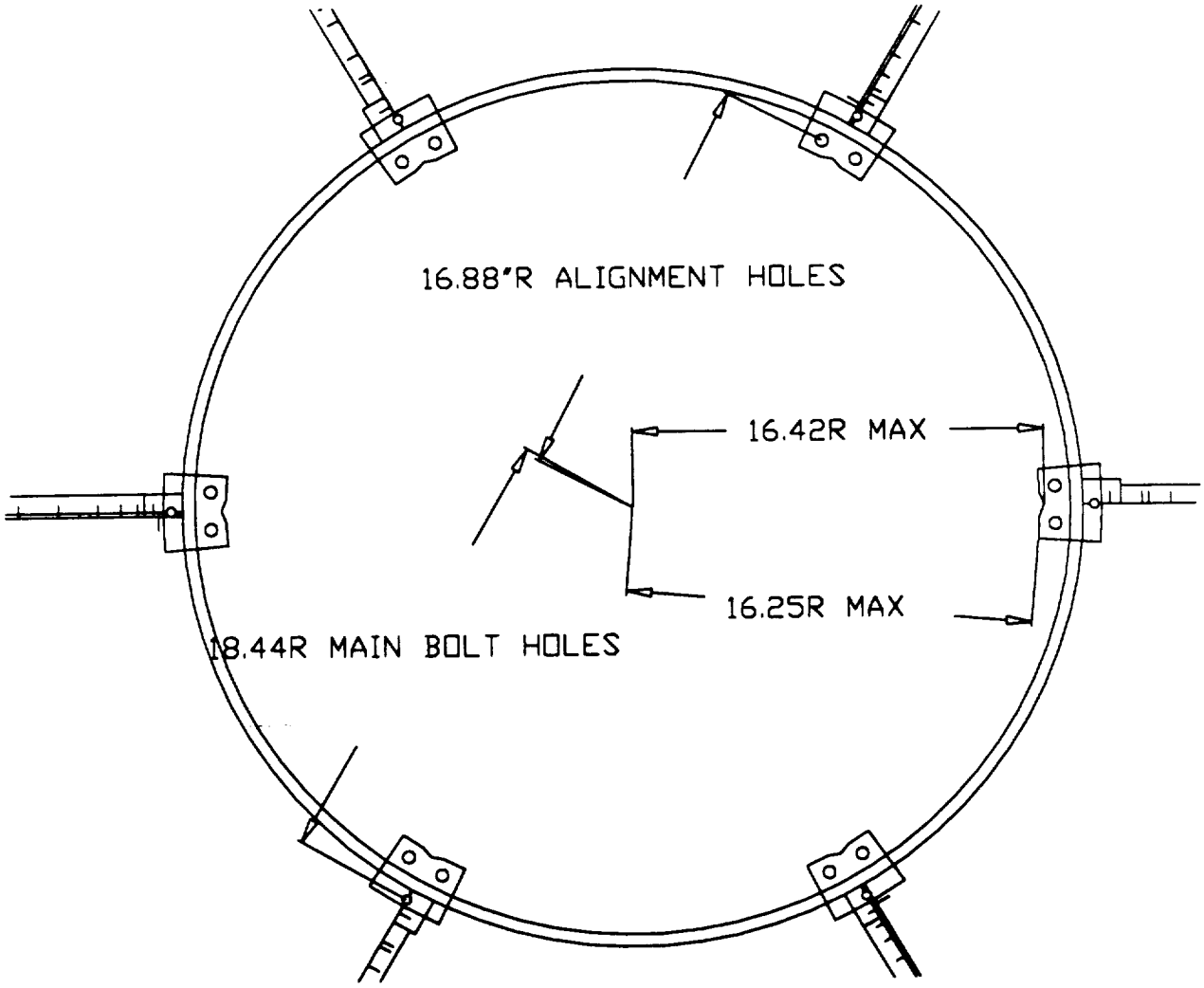

Figure 2. Payload ICD Mechanical Top View

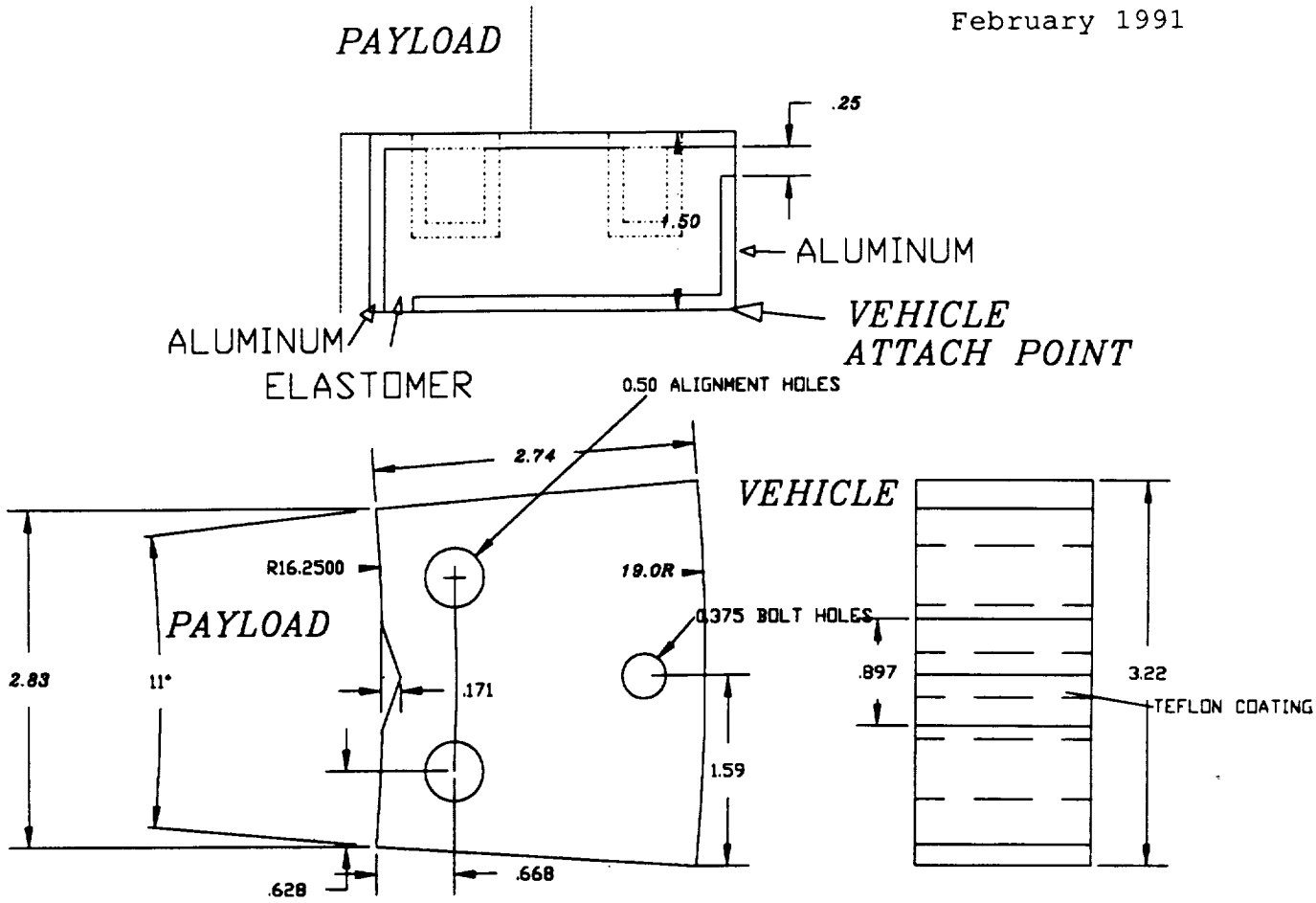

Figure 3. Payload Support Bracket

3.1.5 The payload center of gravity shall be confined to a zone ±7 inches vertically from the attach point and ±1 inch laterally from the centerline. If ballast is required to meet this limitation, the weight of this ballast shall be chargeable to the total weight allowable to the payload. See Figure 1.

3.1.6 The payload weight shall not exceed one thousand (1,000) pounds.

3.2 FUNCTIONAL

3.2.1 Telemetry and Command

3.2.1.1 The transmission of telemetry and command signals between the RRV and the payload shall be in accordance with MIL-STD-1553. All telemetry

To be defined at PDR

Figure 4. Stiffness Matrix

transmitted from the payload shall be suitably digitized and transmission will be controlled by signal from the RRV central computer.

3.2.1.2 The payload contractor shall submit telemetry and control requirements to the RRV contractor. These requirements, as negotiated, will become a part of this specification.

3.2.1.3 Telemetry, command, and power cabling shall be redundant.

3.2.1.4 Placement of data connectors shall be as shown in Figures 5, 6, and 7.

3.2.2 Power Interface

3.2.2.1 The RRV shall provide the payload with 28 ±4V power.

3.2.2.2 The RRV shall be capable of supplying the payload with the following power for the microgravity mission:

a) 136 watts average for the 350 km orbit
b) 155 watts average for the 900 km orbit
c) 332 watts average for the sun-synchronous orbit
d) 2 kilowatts peak if required by special payloads

3.2.2.3 The RRV shall be capable of supplying the payload with the following power for the Artificial Gravity mission:

a) 148 watts average for the 350 km orbit
b) 173 watts average for the 900 km orbit
c) 292 watts average for the sun-synchronous orbit
d) 2 kilowatts peak if required by special payloads

3.2.2.4 Power supplied to payloads in other orbits shall be determined by the RRV contractor upon submission of required orbits by the payload contractor.

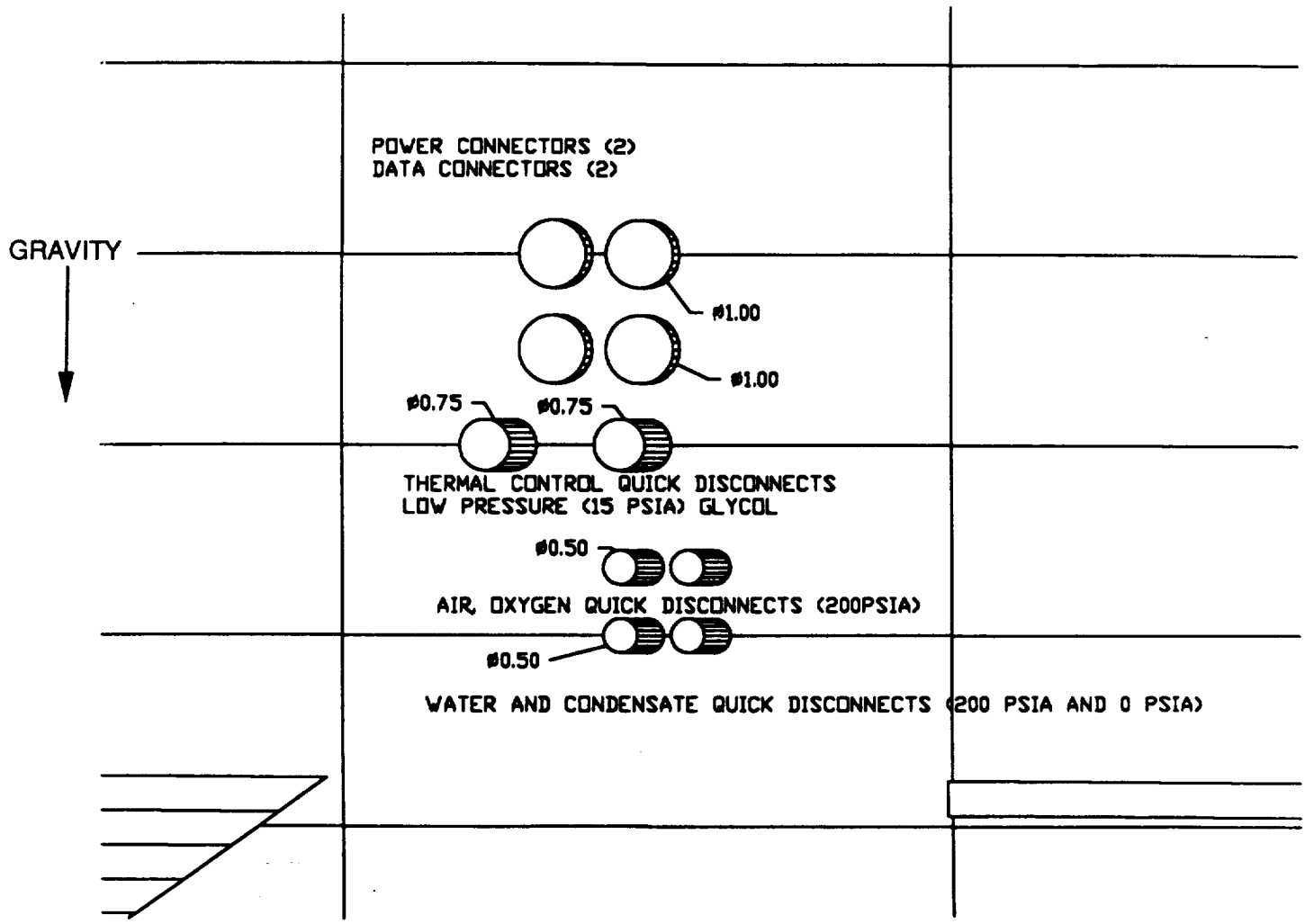

Figure 5. Access to Connections (Top View)

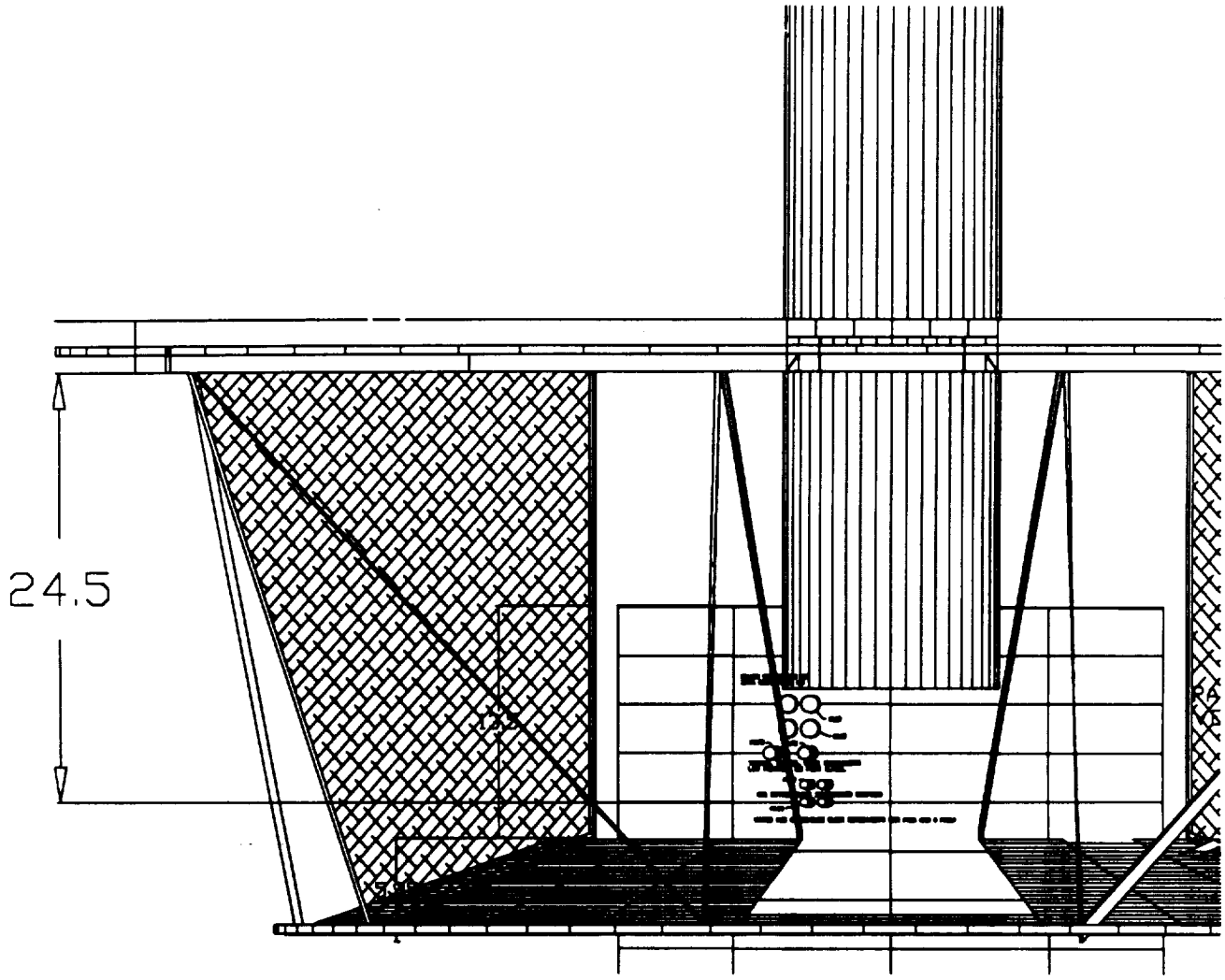

Figure 6. Access to Connections (Side View)

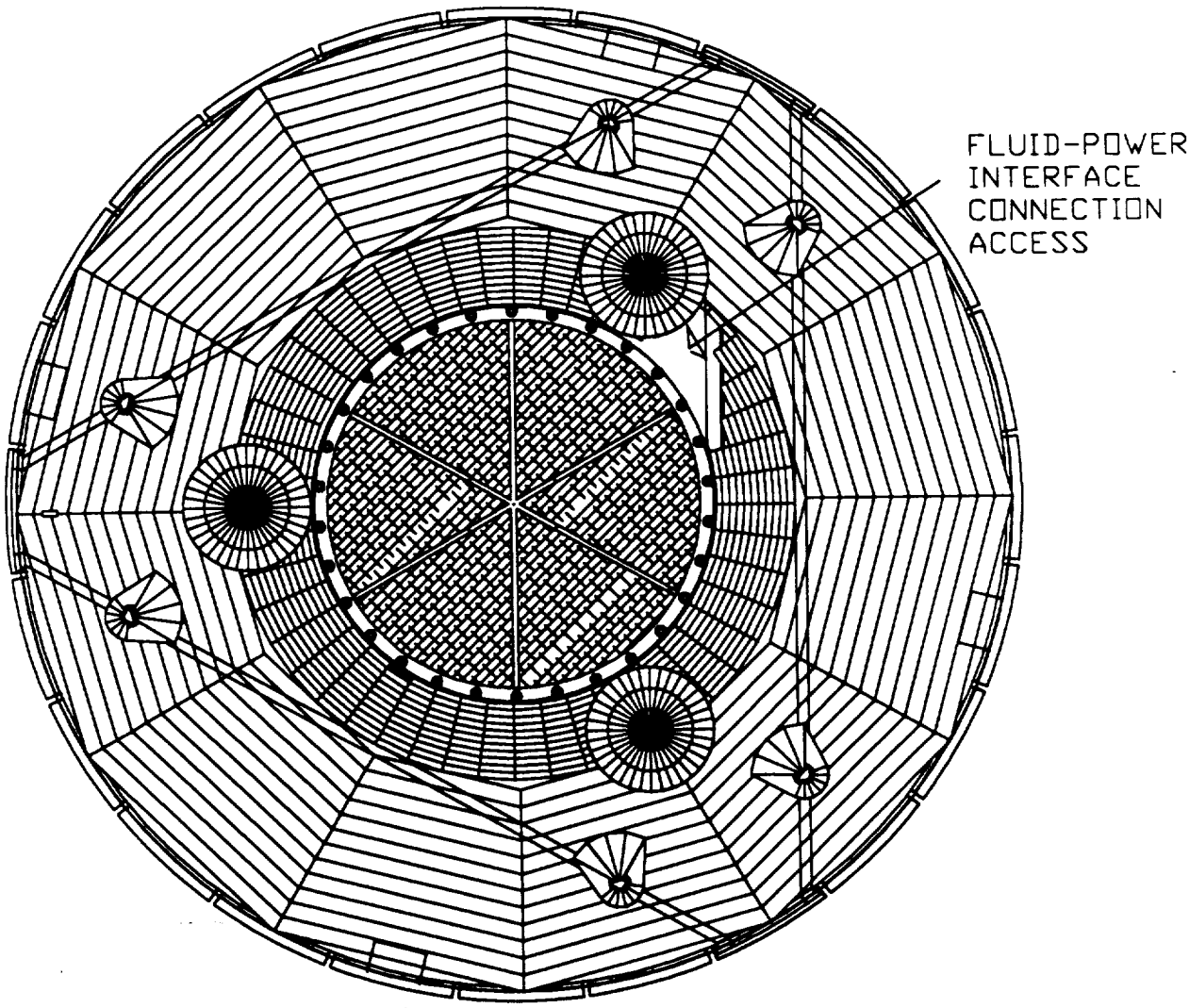

Figure 7. Detailed Fluid and Power Connections

3.2.2.5 Power transfer between the RRV and the payload shall be in compliance with the Electromagnetic Compatibility (EMC) and power specifications listed in Section 2.0 of this document.

3.2.2.6 Power cabling shall be redundant.

3.2.2.7 Placement of power connectors is as shown in Figures 5, 6, and 7.

3.2.3 Fluids and Gases

3.2.3.1 The RRV shall supply 49 pounds of oxygen to the payload at 260 psid.

3.2.3.2 The RRV shall supply 20 pounds of air at 260 psid.

3.2.3.3 The RRV shall supply 133 pounds of water at 50 psid.

3.2.3.4 The RRV shall supply storage for 150 pounds of waste fluid.

3.2.3.5 The gas and fluid quick disconnect locations are as shown in Figures 5, 6, and 7.

3.3 ENVIRONMENTAL

3.3.1 Thermal Environment

3.3.1.1 The RV shall supply coolent fluid of 0.153 Kgm/sec at a temperature of 285°K.

3.3.1.2 The Payload contractor shall submit his thermal requirements to the RRV contractor. These requirements as negotiated will become a part of this specification.

3.3.1.3 Placement of the thermal control quick disconnects shall be as shown in Figures 5, 6, and 7.

3.3.2 Vibration Environment

3.3.2.1 The RRV shall provide shock absorbers at the payload attach points to attenuate launch vehicle-induced vibration and shock levels.

3.3.2.2 The payload contractor shall provide maximum allowable accelerations to the RRV contractor. These requirements, as negotiated, shall become a part of this specification.

3.3.2.3 The payload contractor shall provide a simplified finite element mathematical model to the RRV contractor for use in determining the design of the vibration isolators.

3.3.2.4 The payload contractor shall deliver a structural dynamic model of the payload to the RRV contractor for use in vibration testing of the integrated spacecraft.

3.3.2.5 The RRV shall be capable of providing static acceleration for payload experiments from 0 to 1.5 g on orbit.

3.4 SAFETY

The safety of the RRS, flight experiments, ground personnel, the public, and the prevention of property damage to ground and flight hardware shall be a prime consideration in the design and fabrication of all aspects of the interface as specified herein.

4.0 QUALITY ASSURANCE PROVISIONS

The quality assurance provisions in RRS-SS-100 shall apply to the hardware defined by this interface specification.

4.1 VEHICLE EMULATOR

4.1.1 The vehicle contractor shall supply a Vehicle Emulator to the payload contractor which shall satisfy all the electrical and structural requirements necessary to perform tests with the Payload Module. The VE shall allow the payload contractor to provide payload module design compatibility with the RRV. These requirements are specified in RRS-VS-200 Addendum A.

4.1.2 The VE shall be used for PM Qualification, PE Flight Acceptance Test, On-Pad Stand Down, Post-Flight Recovery, and for experiments using the Ground Control Experiment Module.

4.2 PAYLOAD MODULE EMULATOR (PME)

4.2.1 The payload contractor shall supply a PME to the RRV contractor that shall meet all electrical and structural requirements for interface testing with the RRV. The PME shall allow the RRV contractor to prove RRV design compatibility with the payload. The PME requirements are specified in RRS-PS-200 Addendum A.

4.2.2 A PME shall be used for RRV qualification and RRV Flight Acceptance Test.

5.0 NOTES

TBD

ADDENDUM
A-RM-1

MISSION-UNIQUE REQUIREMENTS
FOR
RODENT MODULE MISSION 1 (RM-1)

A1.0 SCOPE

This addendum describes the mission unique interfaces for Rodent Module Mission 1. These requirements apply to the following flights:

Flight	Integration Date	Flight Date
TBD	TBD	TBD

A2.0 APPLICABLE DOCUMENTS

The following documents of the exact issue shown form a part of this specification to the extent specified herein. In the event of conflict between the documents referenced in this addendum and the contents of the primary specification (RRS-IFS-101) and/or this addendum, the contents of the primary specification shall be considered a superseding requirement.

RRS-MOP-101 (date TBD)	RRS Mission Operations Plan Rodent Module Mission 1

A3.0 INTERFACE REQUIREMENTS

The mission operations profile shall be as defined in RRS-MOP-101.

A3.1 PHYSICAL INTERFACE

No changes.

A3.2 FUNCTIONAL INTERFACES

No change.

A3.3 ENVIRONMENTAL INTERFACES

No change.

A3.4 SAFETY

No changes.

A4.0 QUALITY ASSURANCE PROVISIONS

A4.2 The Payload Module Emulator shall be made available to the vehicle contractor no later than TBD.

A4.3 The Vehicle Emulator shall be made available to the payload contractor no later than TBD.

A5.0 NOTES

No changes.